IDAHO

DEPARTMENT OF FISH AND GAME

Environmental Analysis Report

Proposed

Statewide Lake and Stream Rehabilitation

Bureau of Fisheries
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Chemical Rehabilitation of Fisheries

INTRODUCTION

The chemical rehabilitation of state waters is a part of the fishery management program which began over 20 years ago. It involves the application of chemicals to water to remove undesirable fish species. The chemicals most commonly used have been rotenone and antimycin. Squoxin has been used on an experimental basis in the control of squawfish. Rotenone and antimycin are currently registered for fish control and registration on Squoxin is pending. Rotenone and antimycin are registered by the U.S. Environmental Protection Agency. Squoxin registration has been requested through the 1R-4 program of the Environmental Protection Agency.

Normally treatment occurs late in the summer and waters are restocked before the next fishing season. The proposed action covers a five year period beginning February, 1976.

Removal of predator and competitor species of fish creates a temporary reduction in biomass but results in a higher production of desirable species. The main impact is on the target species; however, some other aquatic forms are temporarily reduced in numbers.

The following alternatives were considered:

Do not rehabilitate,
Use alternate chemicals,
Use means of physical removal,
Use biological controls such as introduction of predator species,
Use physical barriers to prevent rough fish infestation.

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I Description of the Proposed Action

The project will involve the chemical rehabilitation of lakes, reservoirs and streams in Idaho. It is the continuation of a program developed over 20 years ago in which many bodies of water have been treated. The basic principle of the program is the introduction of chemicals to the waters to control or eliminate unwanted fish species. The program was developed to maintain and improve angling opportunities in Idaho. The neighboring states have successful rehabilitation programs similar to Idaho's. California Department of Fish and Game has conducted a lake and stream restoration program for over 20 years, Washington Department of Game has had a lake rehabilitation program for at least 40 years, and Oregon Wildlife Commission has employed chemical rehabilitation for over 30 years.

Waters requiring rehabilitation are located in all parts of the state. Some have been treated in the past but retreatment is anticipated because of incomplete kills, illegal introduction of undesirable fish, or movement of rough fish into reclaimed waters. Substitutions or additions to the following list may be made as conditions warrant. An example would be the elimination of rough fish above a new reservoir.

Water volumes, status of fish stocks, and budgetary limitations will determine what year a water is rehabilitated (see Table 1). The chemical selected will determine the time of year. Rotenone and antimycin are normally used when streams and lakes are at their lowest levels. Because of its rapid degradation Squoxin, if licensed, would be used on streams when velocities are high enough to obtain maximum coverage.

Rehabilitation of lakes and streams is a part of the statewide fisheries management program. It is coordinated with agencies and organizations involved in other water uses.

Chemical application may be by boat, pump or dripper, depending upon the situation. Only chemicals registered for fish control will be used.

Rotenone and antimycin are both registered for use as fish toxicants by the Environmental Protection Agency. Before any fish toxicant can be used legally, it must be registered. In order to be registered basic requirements must be met. This includes determination of the safety of the chemical to man and other mammals, effects of the chemical on fish food organisms, other aquatic animals, and on aquatic and terrestrial plants. The effective doses for various life stages of target animals or plants in waters of various qualities and temperatures must be determined as well as the efficiency in reaching the target organisms. Part of the registration process is defining all cautions that must be exercised during field application. The residues that may be taken up in edible

Table 1. Bodies of water to be considered for chemical rehabilitation during the next 5 years

Water	County	Target species	Chemical	Acre feet or miles
Roseworth Reservoir	Twin Falls	Native cyprinids	Rotenone*	<1,000 acre ft.
Chesterfield Reservoir	Caribou	Cyprinids	Rotenone*	<4,000 acre ft.
Emmett Gravel Pit	Gem	Stunted centrarchids	Rotenone*	62 acre ft.
Rupert Gravel Pit	Minidoka	Cyprinids	Rotenone*	60 acre ft.
Sand Dunes Lake	Owyhee	Stunted bluegills	Antimycin	250 acre ft.
N. Fk. Payette River	Valley	Squawfish	Squoxin**	17 miles @ 500 cfs
St. Joe River	Benewah	Squawfish	Squoxin**	40 miles @ 500 cfs
Island Park Reservoir	Fremont	Utah chub	Rotenone*	10,000 acre ft.
Small ponds and reservoirs	Statewide	Cyprinids Stunted gamefish	Rotenone*	5 – 75 acre ft.

* Antimycin may be substituted for rotenone, if available.

** Squoxin use is pending approval of license.

Substitutions or additions to the above list may be made as conditions warrant.

portions of nontarget animals and plants, their persistence, and any biological magnification of residues in the food chain must also be determined. The migration of residues that may appear in potable water or in meat of livestock is traced. Finally, the degradation, i.e., how the chemical breaks down or disappears, and means of destroying the chemical in water are essential parts of the registration process.

The following information about the properties and uses of antimycin And rotenone as fish toxicants is drawn from summaries prepared by The Fish Control Laboratories, LaCrosse, Wisconsin.

The Federal Environmental Pesticide Control Act of 1972, Public Law 92-156, will upon implementation subsequent to October 21, 1974, require registration (or pre-registration) of all pesticides and certification of all pesticide applicators. Pesticide registration will require tests and the submission of data showing that an acceptable residue tolerance level has been established. If antimycin and/or rotenone are not so registered, alternate chemicals or methods will be used in lieu thereof.

Presently, antimycin is undergoing test for re-registration. Test for re-registration of rotenone are expected to be conducted soon. Continuted authorization for use of these pesticides on Federal and federally supported projects is contingent upon the test results and upon the findings of the Administrator, Environmental Protective Agency.

A. Rotenone – Registration Nos. 432-171, 432-172

Rotenone has been used successfully in removing undesirable fish populations for over 40 years. It is an organic chemical manufactured from cube or derris roots and their derivatives. The fish killing property of the material was discovered by Indians and other primitive people centuries ago and they used it to obtain fish for food.

Refinements over the years have produced a chemical that can be easily applied in known concentrations. Current forms are liquid, synergized liquid and powder. The most commonly produced liquids contain 2.5 percent to 5.0 percent rotenone, 5.0 percent to 100 percent related rotenoids and cube extractives, or 2.5 percent sulfoxide synergist and 85.0 percent to 90.0 percent solvent. Powdered rotenone is prepared in 5.0 percent and 20.0 percent formulations blended with an inert carrier. The only form used in Idaho in recent years is synergized liquid rotenone containing 2.5 percent rotenone, 5.0 percent other cube extracts, 2.5 percent sulfoxide synergist and related compounds and 90 percent solvent.

Natural detoxification of rotenone is dependent upon alkalinity, temperature, and light. Under normal conditions, it can be

expected to biodegrade within one month after application. Rotenone can be detoxified by adding equal parts of potassium permanganate.

Rotenone interferes with blood circulation in the gills of fish by shrinking the capillaries to the point that they no longer carry oxygen-bearing blood cells, thereby causing suffocation.

Concentrations of rotenone (1.0 to 5.0 parts per million) used in fish control have no known effects on mammal or bird life.

B. Antimycin (Fintrol) – Registration; Nos. 89991-5, 6, 7, 8

Fintrol has been used in Idaho since 1969. It is an antifungal, antibiotic isolated from the bacteria Streptomyces. The fermentation extracts are dark, tarry substances which are refined into a fine crystalline material.

Formulations include sand-based Fintrol 5 (1.0% active ingredient), sand-based Fintrol 15 (5.0% active ingredient), liquid Fintrol concentrate (10.0% active ingredient), and Fintrol cake (14.0% active ingredient). The carrier of Fintrol 5 and 15 is sand; that of Fintrol concentrate is acetone; and that of Fintrol cake, wax. One percent of the cake is fluorescein dye which serves as a tracer.

Biodegradation occurs more rapidly than with rotenone and is often complete within 48 to 168 hours. Factors such as sunlight, temperature and alkalinity control the rate of decomposition. Potassium permanganate can be used to hasten the process.

Antimycin is absorbed through the gills of fish where it enters the bloodstream and interferes with the utilization of oxygen in the red blood cells. It does not repel fish and once exposed to a lethal amount the effects are irreversible. Fish eggs are also affected by the chemical.

Concentrations of antimycin (1-10 parts per billion) used in fishery rehabilitation have no known effect on animal or bird life and very little on aquatic organisms. Bullhead catfish are highly resistant to antimycin and concentrations of 40-50 ppb are necessary for their control.

At present, there is no commercial source for antimycin-A fish toxicants. Ayerst Laboratories, the only supplier, dropped the product in 1975. Efforts are underway to find a new supplier as antimycin formulations have some advantages over rotenone in certain types of treatment projects.

C, Squoxin – Registration Pending

Sonar 300, commonly known as Squoxin (1,1'-methylendi-2-napthol) is highly selective for squawfish, a competitor and predator of salmonids in freshwaters of the Northwest (MacPhee and Ruelle 1969; Johnston 1972). It has been used experimentally in Idaho, Oregon, Washington and Canada to gain information on its effectiveness in fish management. Research on its biodegradation and degradation products was conducted at Oregon State University. Reports and data have been submitted to EPA for registration.

The formulation of the chemical most recently used was 39.5 percent of active ingredient, or 3 pounds of the salt per gallon. The balance, or 60.5 percent was denatured alcohol.

Degradation of Squoxin is rapid; often within a few hours. Light and temperature are the two major factors governing the rate of degradation. It is relatively ineffective at temperatures below 55°F and deteriorates rapidly in bright sunlight.

Squoxin is absorbed through the gills and into the blood stream in much the same manner as antimycin. It is believed to effect the motor nerves which control body functions. Reaction to the chemical is similar to antimycin in that the fish gradually lose equilibrium and expire after five or six hours of exposure.

Concentrations used range from 50 to 100 ppb. Salmonids are not affected until the concentration reaches 1,000 ppb. Experiments with aquatic organisms (Keating 1972) indicated that they were not affected in the above concentrations.

II Description of the Environment

The proposed action will affect primarily the aquatic environment. Idaho waters contain three species of salmon, two of trout, Dolly Varden, whitefish, and sturgeon that are considered native game fish. Introduced game species include warm-water fish, walleye, eastern brook trout, lake trout, brown trout, golden trout, and grayling. Rough fish include carp, suckers, tench, chub, chiselmouth, shiners and squawfish.

Water quality determines what species are present in a given body of water. Temperatures, turbidity, pH, and related factors limit certain species of fish to specific areas.

The Endangered Species Act of 1973 (Public Law 93-205); (Stat. 884) establishes two categories of endangerment: a. those species in danger of extinction throughout their range, b. those species likely to become endangered in the foreseeable future. No known endangered species occur in the waters scheduled for rehabilitation. Population sampling prior to treatment is an integral part of the preparation for each project. The discovery of a rare or endangered species would either preclude treatment or necessitate arrangement for salvage and reintroduction of the fish involved. It is conceivable that a project could be beneficial

to endangered species by removing competitors and predators from their environment.

Idaho waters are put to many uses. These include navigation, power production, agriculture, industrial, recreation, livestock, municipal, fish production, and many others. Chemical rehabilitation has no effect on most of the uses although coordination is necessary. It would affect fish rearing and while not harmful, chemicals such as rotenone can impart an undesirable taste and ordor to water used for domestic purposes. The introduction of activated charcoal to water filtration systems has eliminated that problem and had further benefits in clarifying domestic water supplies.

Submergent and emergent plants are not directly affected by chemicals used in lake and stream rehabilitation. The removal of fish populations such as carp can result in a reduction in turbidity and an increase in plant growth.

The application of rotenone results in a short-term reduction in some insect populations. Antimycin and Squoxin have little or no affect on insect numbers. Crayfish are unharmed at normal treatment concentrations. Invertebrate sampling on Big Fall Creek in Oregon in 1965 indicated an 85 percent reduction in insect numbers immediately after treatment with rotenone, however, 2.5 months later the numbers had reached pre-treatment levels. Nutrients recycled to aquatic ecosystems during decomposition of chemical-killed fish usually cause increases in invertebrate populations which serve as food for fish stocked post-treatment.

The effects of rotenone on aquatic invertebrates were reviewed by Taube, Fukano, and Hooper (1954), Almquist (1959), Wollitz (1962), Binns (1967) and Farringer (1972). The U.S. Fish and Wildlife Service supported a 2-year study at the University of Missouri on the long-term effects of rotenone on aquatic invertebrates. The study was completed in 1973. In general, an application of rotenone in fish-killing concentration to a lake or stream may reduce the populations of certain species of aquatic invertebrates, and some species more than others. The evidence is that the reductions are temporary, and the affected species usually make rapid recoveries. The rapid growth of game fish that are stocked in newly reclaimed waters further attests the fact that the invertebrate food base is not permanently damaged by rotenone.

Larval forms of amphibians such as frogs and salamanders, which are gill-breathers, are affected in the same manner as fish when toxicants are applied. Adult air-breathing forms are not harmed and only the current reproductive cycle is interrupted.

Under normal application rates of either rotenone, antimycin or squoxin, mammals and birds suffer no ill effects. Accidental spills of full strength chemicals will cause skin and eye irritations on humans. Full

strength chemicals would have similar effects on mammals and birds, however, such exposure is highly unlikely.

III Environmental Impacts of Proposed Action

The major change will be in the removal of competitor and predator fish and their replacement with species that will provide recreational angling. The fish killed add nutrients to the waters treated, however, they can be removed from inhabited areas.

The action will have no effect on normal land uses. The creation of a good fishery could result in trespass problems on private property. It could also increase land values.

The social benefit will be reflected in the satisfaction of the anglers who benefit from the action. The increase in angler activity will result in an economic benefit to the general area in which the action takes place.

The probability of a catastrophy is remote. No accidents involving chemicals used in fish population control have occurred in Idaho since the program began.

Accidents where chemical spills could occur would result in a short-term concentration in the water receiving them, but there would be no long-term adverse effects. Accidental contact with full strength solutions of chemicals are not harmful if they are removed by immediate washing.

Long-term environmental effects of the degradation products of fish toxicants are not fully understood. Studies could be directed toward the effects of the chemicals on the aquatic food chain and on plant-eating animals. To date no known adverse effects have been documented. Nox fish and pro-noxfish were subjected to extensive toxicity studies over an eight year period by the S.B. Penick Company.

In one facet of the study, male and female rats of the Carworth strain were utilized in one year of feeding studies. The toxicant was given in drinking water. Water that had been detoxified by natural degradation was also used.

After one year of feeding, the rats were examined for gross pathology and the tissues submitted to an outside laboratory for histopathology studies. While there were some differences in weight gains as compared to the con-Trolls, no gross or microscopic differences in pathology were detected.

IV Mitigating Measures Included in the Proposed Action

The use of potassium permanganate to neutralize the chemicals will be a protective measure for downstream fish and other aquatic life. While no rare or endangered species of fish are known to occur in the waters scheduled for treatment, their discovery would lead to their

salvage and reintroduction after treatment.

Water users will have the opportunity to make arrangements in their use schedules. If necessary, activated charcoal can be utilized to restore water quality.

Chemicals will be used according to registration and label requirements.

V Unavoidable Adverse Impacts

The chemical rehabilitation of a lake or stream will result in a temporary reduction in the biomass. Included would be a loss of some game fish and aquatic insects. Some interference in water-oriented recreation can be expected during treatment.

Activities such as swimming and water skiing would be curtailed during the day of treatment. Angling would receive the greatest impact in that it would be eliminated until the waters were restocked.

VI Relationship Between Local Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Rehabilitation of a water results in a temporary loss in productivity and recreational use; however, production of desirable fish will increase and exceed pretreatment levels. A minimum of five years of improved angling can be expected even if all rough fish are not removed. The benefits of a successful treatment can be indefinite.

The ecological change would be replacement or partial replacement of one or more species of competitive nongame fish such as carp, squawfish, sucker, and shiners with game fish which are more desirable to the angling public. No long-range ecological or geophysical consequences are expected.

VII Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable effects are expected because of the lack of physical alteration of the land or water involved and the characteristics of the chemicals proposed for lake and stream rehabilitation.

Generally, concentrations of rotenone used to kill fish in lakes and streams reduce the populations of certain species of aquatic invertebrates. Studies on the effects of rotenone have provided evidence that the reduction of aquatic invertebrates is temporary and the affected species usually make rapid recoveries. Concentrations of antimycin and squoxin used in fishery rehabilitation have little or no affect on aquatic invertebrates.

Adult air-breathing forms of amphibians such as frogs and salamander

would not be harmed by use of rotenone, antimycin or Squoxin in fishery rehabilitation. However, larval forms in the gill-breathing stage may be affected in the same manner as fish and reproduction for the year during which the treatment occurred could be reduced. Resulting reductions in the local population of these animals would be temporary and recovery could be expected within a year or two.

Chemical treatment of lakes and streams would not have a direct affect on birds and mammals but could affect them indirectly for a short time. A localized reduction in the numbers of fish, aquatic invertebrates and amphibians caused by the treatment would result in a reduced food supply for some birds and mammals. Any reduction would be temporary and local in nature and the overall effect on bird and mammal populations would be insignificant.

Rehabilitation projects would be limited to a relatively small area of water during any one year and loss of the fishery in treated waters would be temporary. The waters normally would be restocked with game fish before the following fishing season.

VIII Alternatives to the Proposed Action

A. No action.
Fish populations would eventually stabilize with the most productive and tolerant species becoming predominant. Angler use would remain at a low level.

B. Physically remove undesirable fish.
Trapping, netting and otherwise removing live fish is an expensive and time-consuming effort. The foregoing methods have been tried by various agencies and found to be ineffective in achieving the desired results. Rough fish seining by commercial fishermen is encouraged but does not substantially reduce rough fish populations.

C. Stocking predator fish.
Predator species of game fish can be effective in controlling unwanted species in some situations. However, the unwanted fish may not be a desired food item. Also, predator fish can escape or be promiscuously stocked in waters where they could prey on other game fish. Smallmouth bass and land-locked coho salmon have shown some positive results as predators. Walleye have been introduced in one reservoir. Northern pike have been illegally introduced in one system. Effects of these predators are being monitored but they are not expected to replace chemical treatments in most cases.

D. Barriers.
A barrier to fish movement can only be effective after the initial population above it is removed. This alternative has been employed in some cases.

E. Other chemicals.

Other chemicals can be used to remove rough fish but are often more costly and some have undesirable side effects. Also, only rotenone and antimycin are currently registered for use as pesticides.

IX Consultation and Coordination with Others

Fish and Wildlife Service personnel assisted in the preparation of this statement. Rehabilitation projects are coordinated with land-owners, sportsmen's groups, environmental groups, and water users. The Federal Working Group on Pesticides and state pesticide clearing houses are also contacted. Local news media are informed and public hearings are held in the event of conflicting interests.